THE WAX-SECRETING MECHANISM IN THE ADULT FEMALE OF ICERYA PURCHASI MASKELL

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Apparently there has been but one paper published in which there is a direct reference to the histology of the wax-secreting glands of *Icerya purchasi* Maskell, the cottony cushion scale.[1] This paper was not primarily concerned with the glands, discussing them in a single short paragraph, and this appears to be largely in error. The study of these structures, especially of the pores, is difficult, even with the aid of good histological preparations and with an oil-immersion lens.

Icerya purchasi has been given the common name of "cottony cushion scale" because of its appearance in life. When the ovisac in which the eggs are deposited is fully developed the insect itself is inconspicuous in comparison with the amount of cottony material with which it is invested. Apparently there is no time during the life of the insect in which the wax is not secreted, although the distribution of the compound pores from which the wax issues varies greatly in the different stages. There are also differences in the types of pores to be seen in the different instars. We are concerned here only with those to be found in the adult female.

In the adult female the most abundant pores are of the type shown in Fig 1A. These pores are distributed generally over the body, but are especially concentrated into a large ring on the ventral side of the abdomen, this ring enclosing the vulva. It is evidently from this ring that the outer, rather firm, wall of the ovisac arises. There are from four to five times as many pores per unit of area in this ovisac ring as there are on any other part of the body. The wax arising from these pores can be seen to issue in the form of slender spiral rods that measure from one to two microns in diameter, the entire group of these arising from a single compound pore forming a tuft and these

1. Johnson, Carl. The internal anatomy of Icerya purchasi. Annals Entomological Society America 5:383-388; pl. 28 (1912).

tufts being aggregated to form the general waxy covering of the body. The great numbers of slender setæ with which the skin is beset seem to function as supports for the masses of secretion which form upon them.

In the adult female there may be seen numerous long, slender, glassy rods of wax that radiate from the body. These are not at all of the characteristic spiral form in which the rest of the secretion issues, but are straight rods, appearing to be round, but upon close examination proving to be formed from two solid rods. Each of these rods is in section of the form of a half circle, the flat surfaces being approximated. These rods agree in distribution and number with, and undoubtedly issue from, certain large pores which are distributed around the periphery of the body in small numbers.

Altogether, three distinct types of pores are to be found, one (Fig. 1A) apparently producing the greater part of the secretion and being responsible for the ovisac; a second (Fig. 1B) being responsible for the glassy rods; and a third (Fig. 1D) which I have not been able as yet to correlate with a definite type of secretion. The pores of this third type are distributed over the entire surface of the body, many more per unit of area being present on the ventral side than on the dorsal. They are not commonly found among the pores composing the ovisac ring, but are numerous just outside and just inside of the ring and over the area enclosed by it.

The compound pores of the commoner type (Fig. 1A) are approximately twelve microns in length and ten in width. As viewed in the ordinary dermal preparation it is impossible to be certain of the exact structure of these pores, and a clear understanding can only be obtained, if at all, from histological sections. In a dermal preparation the compound pore appears as an outer ring, connected to a much smaller inner ring by heavy buttress-like cross walls that separate small compartments, the inner ring itself being divided by a cross wall to form two compartments. Of the outer compartments or loculi there may be from eight to twelve.

The correlation of this appearance with a vertical section is

shown also in Fig. 1A. It may be noted that each compartment or loculus opens to the interior by an extremely minute pore, which in the case of the peripheral loculi seems to be continuous with a very short duct. The cross wall, separating the two central loculi evidently divides the wax issuing from the two pores, and in the case of this type of compound pore the wax from the central openings, as well as that from the peripheral openings issues in the form of small spiral rods.

It appears that the wax, issuing from the minute pores as a liquid hardens and takes form in the outer chambers, which act as molds.

The pores of the larger type, from which the glassy threads arise appear in surface view as shown in Fig. 1B. In general these compound pores are about fifteen microns in diameter and are nearly round. They differ from the smaller pores just described chiefly in details. It will be noted that the peripheral loculi are relatively much smaller than in the other type, that the central ring is larger and heavier and the cross wall of the central ring is only about half as high as the outer walls (Fig. 1C).

The wax from the peripheral pores forms in small spirals, but that from the central loculi forms the glassy rods, each of which, as has been pointed out, is made up of two rods that are semicircular in section with their flat surfaces approximate. The mechanical reasons for the differences in form of the secretions arising from the two types of compound pores, aside from any possible chemical difference in the wax, would seem to lie perhaps in the difference in size of the rods of wax and in the difference in height of the central cross wall. Apparently this short cross wall, while separating the wax as it issues from the two central pores long enough to permit the two rods to harden partially, still does not keep them sufficiently far apart to prevent some final contact of their median surfaces and they consequently partially stick together and issue as a single compound rod.

The delicate duct indicated as continuous with the pore of one of the central loculi in Fig. 1C, is extremely difficult to see and to trace, yet it seems quite certainly to be present.

The third type of pore, the surface appearance of which is

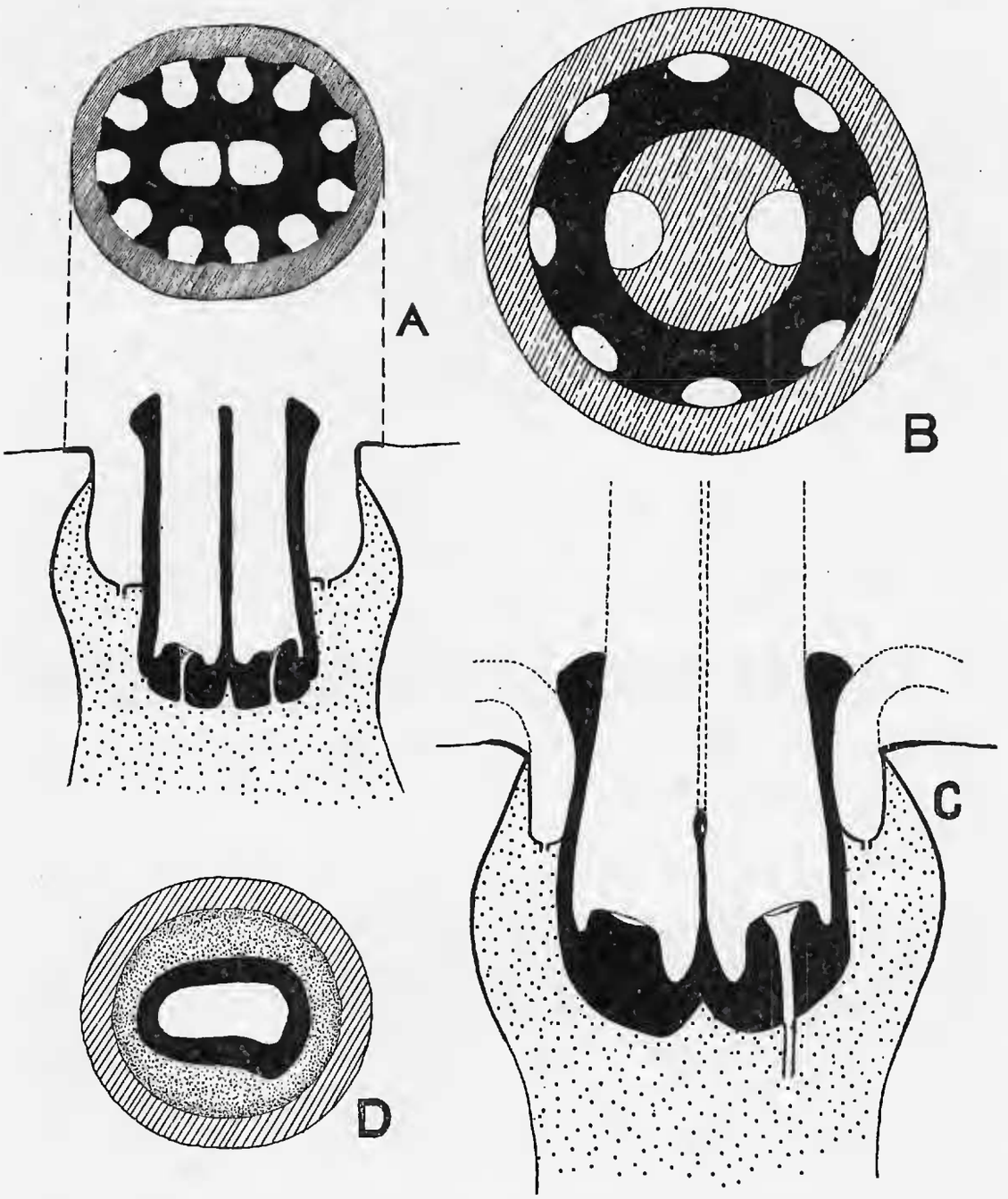

Fig. 1. Compound wax pores of *Icerya purchasi* Maskell. A, surface view and vertical optical section of most abundant type; B, surface view of type from which glassy rods arise; C, vertical optical section of same; D, surface view of third type of pore.

shown in Fig 1D, has not yet been studied in sections and cannot be reported upon.

The glands which underlie these pores seem all to be of a single general type, varying in size and in form as they may be crowded together or comparatively free. They all consist of a cluster of enlarged hypodermal cells (Fig. 2), there being

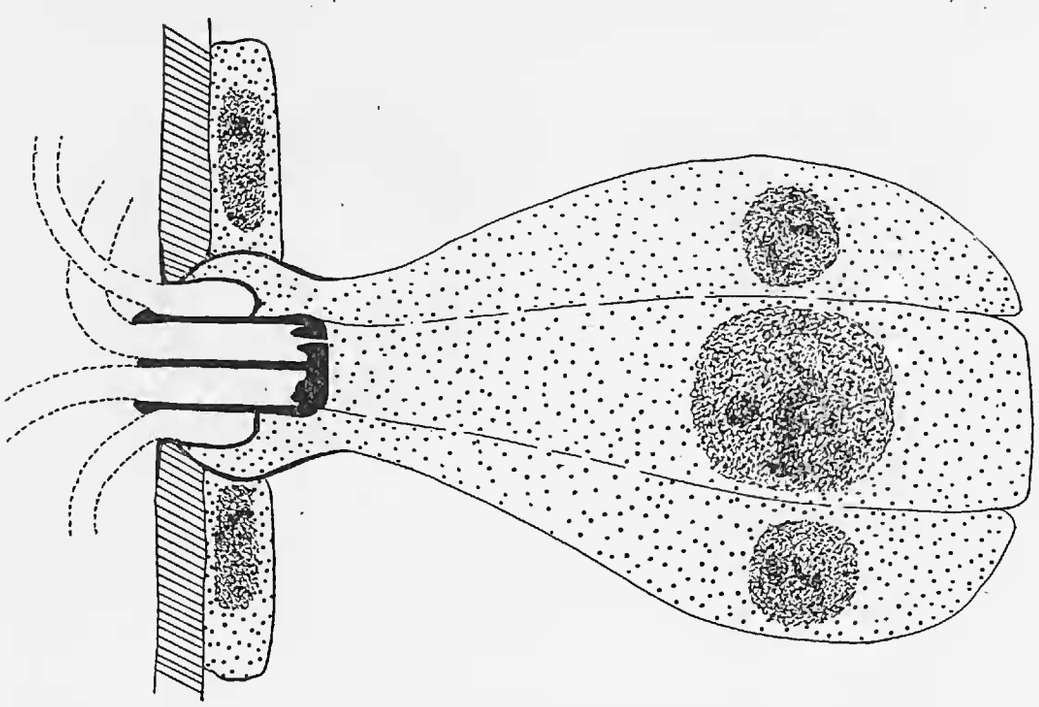

Fig. 2. Optical longitudinal section of gland and pore.

a single large central cell surrounded by an outer series of smaller cells. Apparently, as far as can be determined by actual count, there is one outer cell for each peripheral opening of the compound pore, each cell thus discharging its contents through one of these pores. Apparently, also, the large central cell discharges its contents through the two central pores. No differences are to be detected between the glands that serve the two types of pores that have been described.

These glands possess no storage reservoir or lumen as do the glands in some other scale insects. Apparently they secrete the wax as rapidly as it is formed. In none of the numerous preparations examined was there any evidence of vacuolation of the cell contents or any evidence that a cell becomes exhausted. Secretion apparently begins very early at the time of molting, for specimens not yet molted have been dissected from their old skins and microscopic examination showed that the new skin in process of formation was well covered with threads of wax.

Both yellow and white wax is to be found upon the bodies of these insects, but at present no information is available concerning the origin of the two colors. Possibly the yellow wax is secreted by the third type of pore, which still remains to be investigated.